Spot Safety Project Evaluation

Project Log # 200702007

Spot Safety Project # 10-98-002

Spot Safety Project Evaluation of the Traffic Signal Installation at NC 160 and SR 1155 (Shopton Rd) Mecklenburg County

Documents Prepared By:

Safety Evaluation Group
Traffic Safety Systems Management Section
Traffic Engineering and Safety Systems Branch
North Carolina Department of Transportation

Principal Investigator

Samuel D. Coleman, EI

Traffic Safety Project Engineer

Date

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 10-98-002 – Traffic Signal and Left Turn Lane Installation at NC 160 and SR 1155 (Shopton Rd) in Mecklenburg County.

Project Information and Background from the Project File Folder

NC 160 has a speed limit of 50 mph at the intersection with SR 1155. On the north approach to the intersection, NC 160 has a thru lane and a dedicated right turn lane. On the south approach, there is a thru lane and a dedicated left turn lane. SR 1155 has a speed limit of 45 mph when approaching the 3-leg treatment intersection. There are three lanes on SR 1155 at the intersection, two lanes for right and left turning westbound vehicles and one lane for eastbound traffic. Please note that the right and left turn lanes were funded by the West Charlotte Outer Loop (I-485) project. The cost of construction for the turn lanes was not specified within the project file folder.

The original problem statement shows there is a high volume of southbound left turning and northbound traffic on NC 160. With the addition of a highway interchange approximately 1600 feet south of the treatment intersection, northbound traffic would increase making it more difficult for the southbound left turning vehicles to maneuver. The original crash analysis yielded 7 total crashes from 1/1/1995 through 12/31/1997. There were 5 Rear End crashes, 1 Left Turn same roadway, and 1 Ran Off Road crash. The improvement chosen for the subject location was to install a traffic signal and queuing detection to provide a left turn phase for the southbound vehicles on NC 160. The final completion date for the improvement at the subject location was on May 30, 2002 at a total cost of $30,000.

Naive Before and After Analysis

After reviewing the spot safety project file folder along with all the crashes along the subject road, the crash data omitted from this analysis to consider for an adequate construction period was from April 2002 through June 2002. The before period consisted of reported crashes from December 1, 1997 through March 31, 2002 (4 years, 4 months) and the after period consisted of reported crashes from July 1, 2002 through October 31, 2006 (4 years, 4 months). The ending date for this analysis was determined by the available crash data at the time the crash analysis was completed.

The treatment data consisted of all crashes within 150 feet of the subject intersection. The following data table depicts the Naive Before and After Analysis for the above information. Please note that southbound Left Turn Crashes were the target crashes for the applied countermeasures. These crash types considered are as follows: Left Turn, same roadway; Left Turn, different roadway; Head On, and Angle.

Treatment Information			
	Before	**After**	**Percent Reduction (-) Percent Increase (+)**
Total Crashes	18	20	11.1
Total Severity Index	2.6	4.7	77.7
SB Left Turn Crashes	4	2	-50.0
Left Turn Severity Index	6.6	8.4	28.2
Volume	19400	23650	21.9
Treatment Injury Crashes			
	Before	**After**	**Percent Reduction (-) Percent Increase (+)**
Fatal	0	0	N/A
Class A	0	0	N/A
Class B	0	2	N/A
Class C	4	8	100.0
Property Damage Only	14	10	-28.6
SB Left Turn Injury Crashes			
	Before	**After**	**Percent Reduction (-) Percent Increase (+)**
Fatal	0	0	N/A
Class A	0	0	N/A
Class B	0	0	N/A
Class C	3	2	-33.3
Property Damage Only	1	0	-100.0

Table 1.

The naive before and after analysis at the treatment location resulted in an 11 percent increase in Total Crashes, a 50 percent decrease in SB Left Turn Crashes, and a 22 percent increase in Average Daily Traffic (ADT). The before period ADT year was 2000 and the after period ADT year was 2004.

Results and Discussion

The naïve before and after analysis involving the comparison of treatment actual before data versus treatment actual after data resulted in a 11 percent increase in Total Crashes and a 50 percent decrease in SB Left Turn Crashes. The summary results above demonstrate that the treatment location appears to have had an increase in the number of Total Crashes and a decrease in the number of SB Left Turn Crashes from the before to the after period.

Referencing Table 1 the severity for both total and target crashes have shown an increase. Within the B and C class injuries in the after period (10 total), two C class injuries resulted from the targeted crash pattern. The other 8 (2-B, 6-C) occurred from rear end collisions. Examining the before and after collision diagrams, it seems a majority of the rear end crashes migrated from the southbound lanes of NC 160, approaching the intersection, to the northbound lanes.

In the before period the southbound rear end crashes may be attributed to left turning vehicles. The reason being that 6 out of 7 of the crashes have an estimated speed for the at fault vehicle of 30 mph or less. This may indicate the vehicle in front of it was stopped or slowing down considerably resulting in a low speed crash.

In the after period there are seven rear end crashes in the thru lane of NC 160 northbound. The crash reports indicate the front vehicle was stopped for all seven crashes. There is no left turn movement for the northbound vehicles and there is a separate right turn lane which may indicate the rear end crashes are not occurring due to northbound turning vehicles. There may be a sight distance or timing issue for the northbound vehicles. Although neither of these issues were noted during the field visit they may become evident during peak hours.

The calculated benefit to cost ratio for this project is –2.89 considering total crashes. The benefit to cost ratio considering only target crashes is 0.68. The benefits are calculated using the change in annual crash costs from the before to the after period. Operational and other benefits related to the project are not considered in this analysis. The costs of the project include the actual construction costs as well as the increase in annual maintenance and utility costs.

As the Safety Evaluation Group completes additional spot safety reviews for this type of countermeasure, we will be able to provide objective and definite information regarding actual crash reduction factors for this type of road.

TREATMENT BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: NC 160 at SR 1155 BY: SDC
COUNTY: Mecklenburg DATE: 6/19/2007
FILE NO.: SS 10-98-002

DETAILED COST: TYPE IMPROVEMENT - Signal

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$30,000	10	0.149	$4,471
	$0	0	0.000	$0
Right-of-Way	$0	0	0.000	$0
TOTALS	$30,000	10	0.149	$4,471

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $2,000
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $900

TOTAL ANNUAL COST= $7,371
TOTAL COST OF PROJECT= $30,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

TIME PERIOD	YEARS	K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	ANNUAL COSTS
BEFORE	4.34	0	0.00	4	0.92	14	3.23	$29,171
AFTER	4.34	0	0.00	10	2.30	10	2.30	$50,461

Annual Benefits from Crash Cost Savings ($21,290)

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = ($28,661)

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = -2.89

TOTAL COST OF PROJECT - $30,000 COMPREHENSIVE B/C RATIO - -2.89

TARGET BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: NC 160 at SR 1155 BY: SDC
COUNTY: Mecklenburg DATE: 6/19/2007
FILE NO.: SS 10-98-002

DETAILED COST: TYPE IMPROVEMENT - Signal

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$30,000	10	0.149	$4,471
	$0	0	0.000	$0
Right-of-Way	$0	0	0.000	$0
TOTALS	$30,000	10	0.149	$4,471

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $2,000
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $900

TOTAL ANNUAL COST= $7,371
TOTAL COST OF PROJECT= $30,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

TIME PERIOD	YEARS	K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	ANNUAL COSTS
BEFORE	4.34	0	0.00	3	0.69	1	0.23	$13,341
AFTER	4.34	0	0.00	2	0.46	0	0.00	$8,295

Annual Benefits from Crash Cost Savings $5,046

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = ($2,325)

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 0.68

TOTAL COST OF PROJECT - $30,000 COMPREHENSIVE B/C RATIO - 0.68

Location Map: NC 160 (Steele Creek Rd) and SR 1155 (Shopton Road) in Mecklenburg Co.

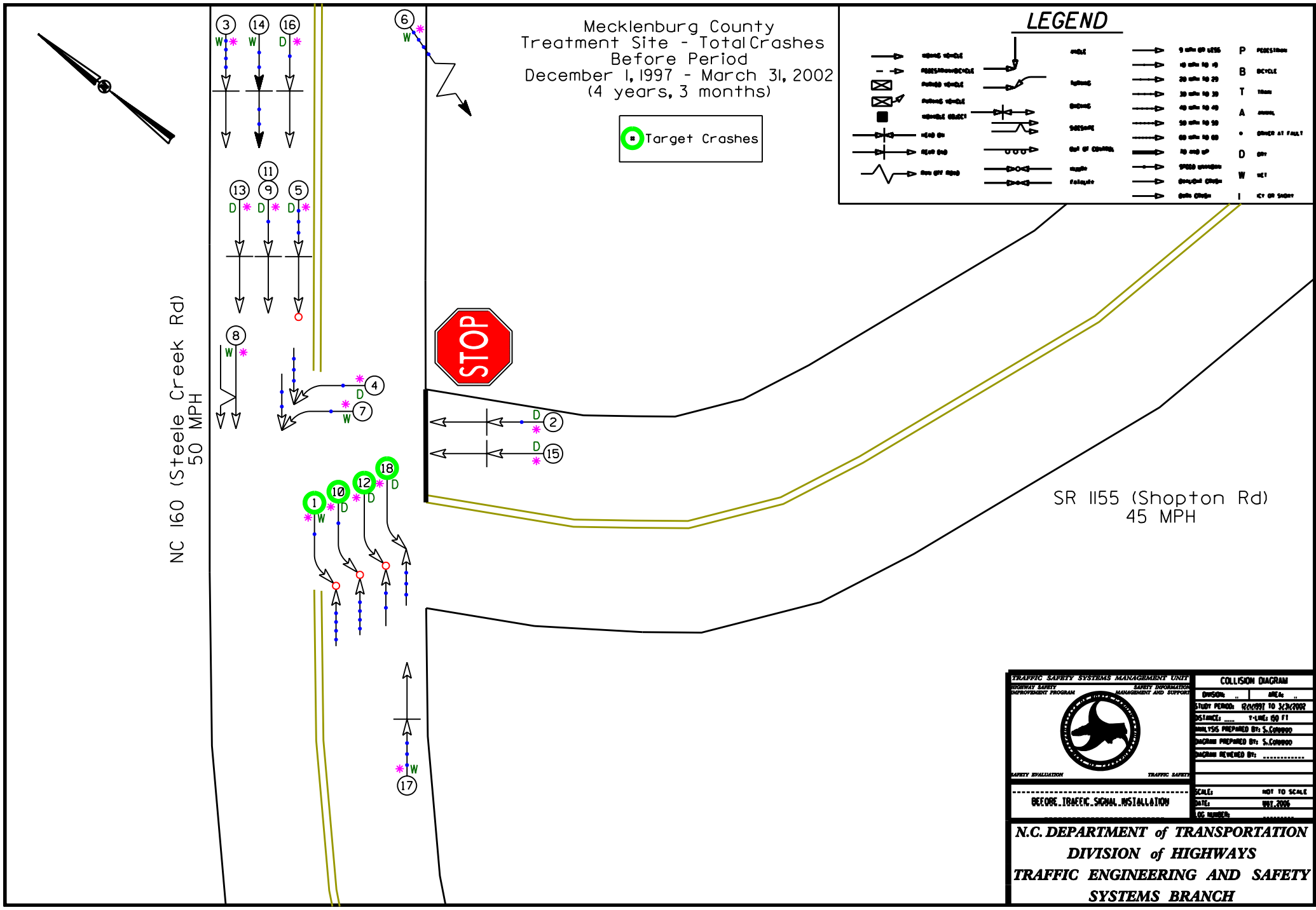
Treatment Site Photos taken March 23, 2007

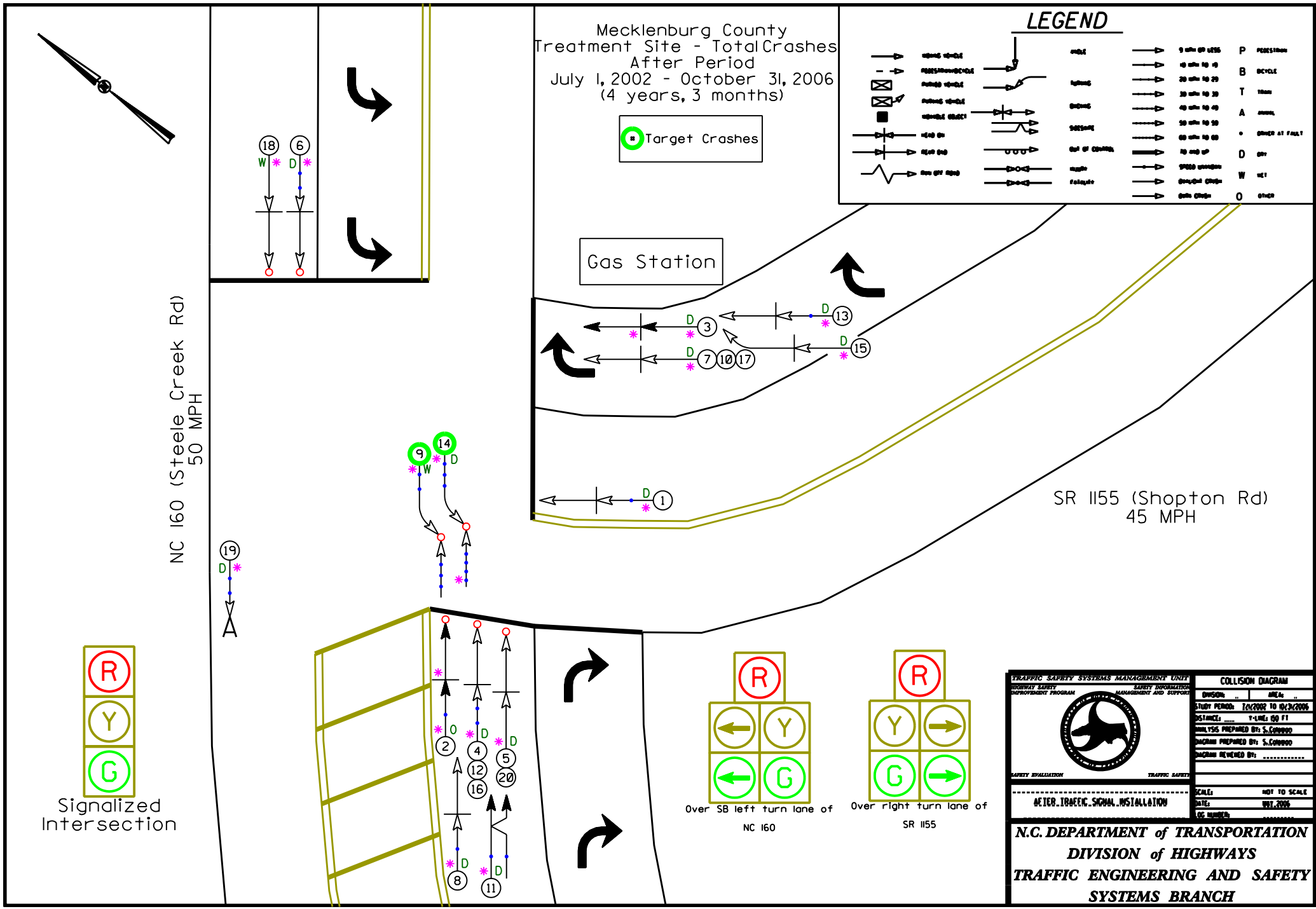
Driving south on NC 160

Driving south on NC 160

Driving north on NC 160

Driving west on Shopton Rd


Mecklenburg County
Treatment Site - Total Crashes
Before Period
December 1, 1997 - March 31, 2002
(4 years, 3 months)
Target Crashes
LEGEND
NC 160 (Steele Creek Rd)
50 MPH
SR 1155 (Shopton Rd)
45 MPH
STOP
3
14
16
6
11
13
9
5
8
4
7
2
15
18
12
10
1
17
TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT
HIGHWAY SAFETY IMPROVEMENT PROGRAM
SAFETY INFORMATION MANAGEMENT AND SUPPORT
SAFETY EVALUATION
TRAFFIC SAFETY
COLLISION DIAGRAM
STUDY PERIOD: 12/1/1997 TO 3/31/2002
SCALE: NOT TO SCALE
DATE: MAY 2006
BEFORE TRAFFIC SIGNAL INSTALLATION
N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY
SYSTEMS BRANCH


Mecklenburg County
Treatment Site - Total Crashes
After Period
July 1, 2002 - October 31, 2006
(4 years, 3 months)
Target Crashes
LEGEND
Gas Station
NC 160 (Steele Creek Rd)
50 MPH
SR 1155 (Shopton Rd)
45 MPH
Signalized Intersection
Over SB left turn lane of NC 160
Over right turn lane of SR 1155
TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT
COLLISION DIAGRAM
AETER_TRAFFIC_SIGNAL_INSTALLATION
N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY
SYSTEMS BRANCH